

U.S. Geological Survey Asian Carp Research Update

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U. S. Geological Survey

State of Lake Michigan Conference

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USGS Asian Carp Activities

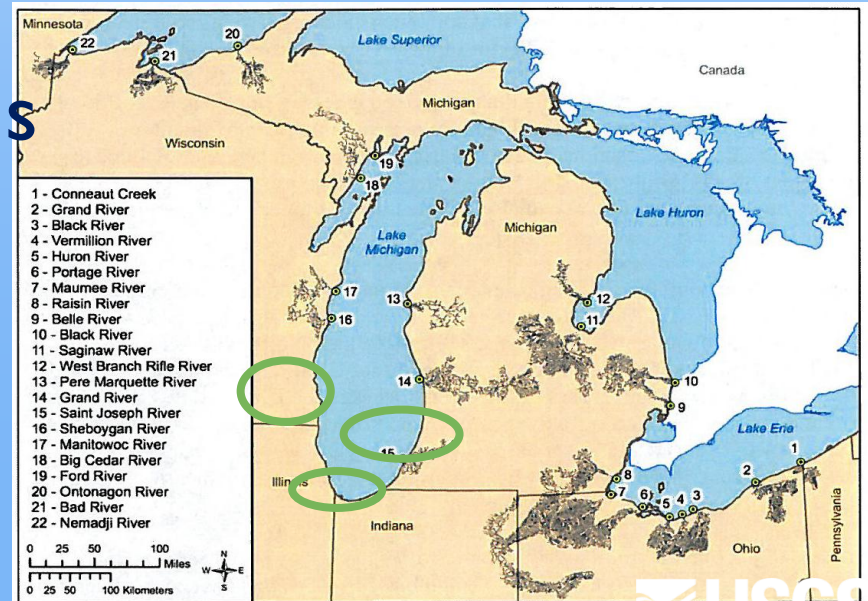
Areas of Focus

- Can they get to the Great Lakes? (Risk Assessment)
- Can they develop a sustained reproductive population? (Risk Assessment)
- How can they be controlled? (Risk Management)



Biological Risk Assessment

- Can Asian carp Survive and Develop Reproducing Populations in the Great Lakes?
- Assess suitability of tributaries as spawning habitat for Asian carp
- Determining conditions needed for successful spawning



Fish Behavior Studies:

Tributary Assessment project

- Published USGS Scientific Investigations Report in August on egg and larval Asian carp development
- Data being incorporated into model for development of predictive tool

Suitability of the Maumee River for Spawning of Bighead Carp

- Question: Do conditions favorable for spawning Asian carp exist in Lake Erie and the Maumee River?



Initial Maumee River Findings

- Maumee River appears to be thermally and hydrographically suitable for spawning of bighead carp
- Additional research needed to identify potential spawning locations or to determine if entire river length is suitable for development of mitigation options
- Study methods are being applied to six other major tributaries: Sandusky, Portage, Huron, Vermilion, Black, Grand (OH)

Biological Risk Assessment

- Assess risk for Asian carp establishment based on available food sources
 - Feeding (food source) studies
 - Testing bioenergetics model that says Asian carp cannot survive in Lake Michigan



Fish Behavior Studies:

Is there Food for Carp in the Great Lakes?

- Preliminary Findings:
 - Silver carp are feeding on *Cladophora*, a green algae prevalent in GLs
 - Bighead carp eat detritus [bottom muck].
- Bioenergetic model – can they survive?
- Final results expected in late 2011/early 2012

Biological Risk Assessment

- Can Asian carp survive on bluegreen algae (cyanobacteria)?
- Yes (tentatively) despite presence of microcystin toxin in carp tissue
- Being eaten may even be good for bluegreens



Biological Risk Assessment Fish Condition Studies

- Effects on Native Fish in Mississippi River System (not GLRI project)
- Compared pools with and without abundant Asian carp
- When AC abundant native fish:
 - Are in much poorer body condition
 - Less successfully reproduce
- USGS is doing additional research on how far up the food chain (macro invertebrates and birds) these effects are observed

Control Strategies

- Chemical Control
- Biological Control
- Physical Control
- Combinations (IPM)
- IPM approach modeled after successful sea lamprey control in the GL



Biocide Control Strategy

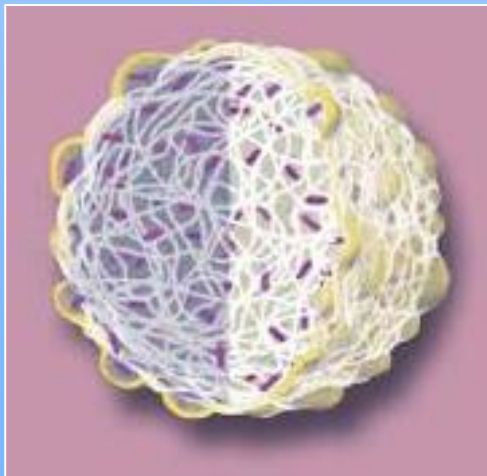
Target invasive while minimizing non-target organism effects through:

- Selective agent (biological or chemical)
- Selective uptake by invasive
- Selective release within invasive species

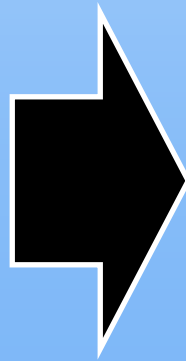


Biocide Controls

Developing an oral delivery formulation (ODF) to selectively deliver biocides to control filter feeding aquatic invasive species



ODF



Oral Delivery Formulation

ODF Requirements:

1. Incorporate or “hold” the biocide
2. Readily consumed
3. Size specific
4. Releases biocide under “targeted” conditions
5. Scaled production

Targeted Oral Delivery

Characterization of target delivery sites in invasives and native aquatic animals

- Gastrointestinal tract – enzyme activity and physiology
- Gills
- Skin

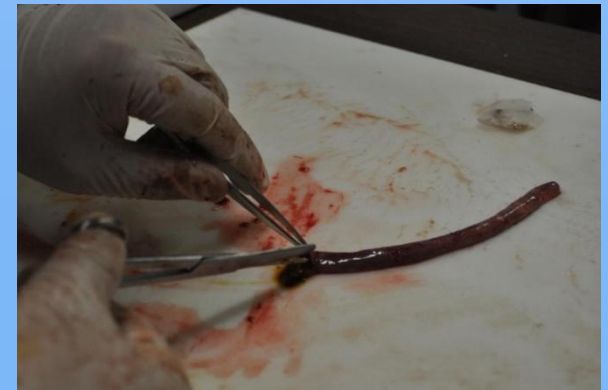


Summary of Preliminary Results

- **What we know:**
 - Asian carp will consume ODF
 - Silver carp target 50-70 μm particles
 - Overlap with gizzard shad
 - Asian carp have higher activity of trypsin
 - Asian carp have higher activity of phosphatases
 - Asian carp actively eat earlier in the year than natives

Significance

- Potentially design a particle
- 50-100 μm
- Trypsin required to release toxin
- Applied in late winter or early spring



USGS and eDNA

eDNA Calibration and Increased Efficiency

- The purpose of a calibration scope of work is to quantify the correlation between the number and distribution of positive detections with the density of Asian carp.

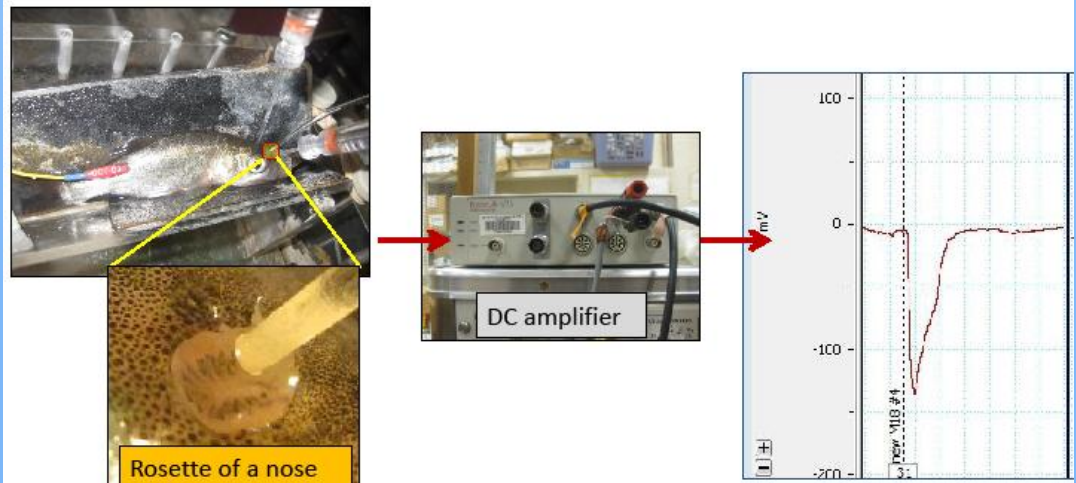


Pheromones for Carp Control

- Tools for attracting and herding Asian carp
- Enables control methods to target Asian carp and reduce risk to native fish

Electro-olfactogram (EOG)

- 1) Olfactory responses to specific odorants
- 2) A great screening tool



Pheromones – Recent Results

- Asian carp are highly sensitive to sex hormone metabolites in physiology studies of the olfactory system and are behaviorally attracted to them.
- Female carp can be hormonally induced to release sex pheromones that are effective as olfactory stimulants and induce attraction.

Physical Methods- Control/Prevention

- Evaluate physical methods to decrease egg viability
 - Response of Asian carp eggs to electrical fields and sonication



Physical Methods- Control/Prevention

- Use of seismic technology to divert or eradicate invasive Asian carp
 - Water guns - Effects of different sound wave frequencies on various age classes of fish at different distances
 - Assess Structural Effects of water guns
 - Provide electric barrier shutdown support



Water Gun Testing – Sound Energy Barriers

- Observe fish behavior
 - Will it keep fish away?
 - How many guns needed?
- Different size guns tests
 - Differing frequencies
 - Differing peak pressures

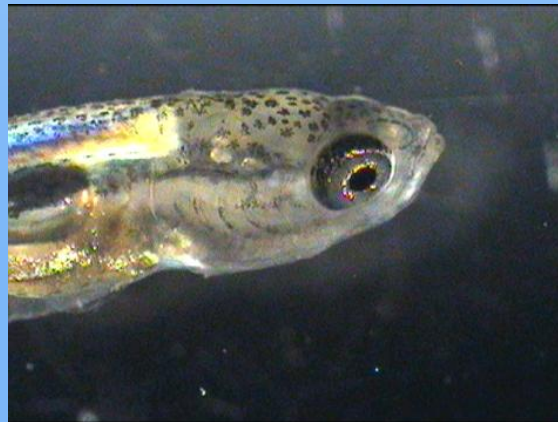


Upcoming Water Gun Testing

- September 26-28: Plan to conduct structural effects study in CAWS (USGS/USACE/IL DNR and Northern IL University)
- October 17-29 – Behavioral studies (USGS and IL DNR)
 - Will test different size guns, differing frequencies, and differing peak pressures
 - Observe fish behavior – use of real time acoustic telemetry tags and sonar
 - Determine number of water guns needed

Potential for Inter-basin Transfer

- Potential Asian carp migration (eggs/larvae) via surface or ground water pathways between Des Plaines River and/or I&M Canal to CSSC
- Wabash/Maumee Rivers – potential inter-basin transfer



USGS and Partner Objectives

- New management tools to control or remove carp
- Actively and efficiently managing science
- Working toward direct transferability of invasive species control technology and methods across the nation
- Building a framework for tool development
 - Standardize creation of methods and tools which can then be tailored and applied to control other invasive species

Addressing GLRI Action Plan Goals

- Contributing to IPM program – control/eradication
- Minimize risk of species introduction – through risk assessment and control studies
- Eliminate new AIS introductions – apply strategies and knowledge gained from this research

Questions?

